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THE determination of types or typical forms of natural objects is one of the most interesting as well as one of the most important subjects that can engage the attention of the biologist; for, in investigating the morphological relations between the various groups of organized bodies which form the subject matter of his study, the student of biology must necessarily have in his mind a more or less clear conception of the typical forms of the groups in question.

In determining, for instance, whether two allied groups of animals are to be regarded as varieties, or as distinct species, the naturalist will compare together not two individuals selected at random from each group, but two individuals carefully chosen for their conformity to what may be regarded as the average size, proportions, and general appearance of the group to which they belong.

In this selection of individuals as representatives of groups, a great deal will depend upon the experience and good judgment of the person making

the selection, and two equally competent observers may differ materially in their choice of forms which they regard as typical. It is, of course, very desirable to remove this subjective source of error and to give to the typical form a truly objective character.

As far as size and proportions of the body are concerned, this result may be attained by measuring and weighing large numbers of individuals belonging to a given group, and from the figures thus obtained calculating by well-known statistical methods the mean or median values of the dimensions selected for study as well as the extent of individual variation from these values. From the relation which these dimensions bear to each other, typical forms may be deduced, which, though not accurately representing any individual in the group, are yet more truly *representative* of the group than any individual can be, for they are ideal forms round which individuals group themselves in accordance with the law of accidental variation, as shots group



PLATE I. TWELVE BOSTON PHYSICIANS AND THEIR COMPOSITE PORTRAIT—THE COMPOSITE IN THE CENTRE.



PLATE II. THE SAME FACES SHOWN IN PLATE I., PHOTOGRAPHED FIVE YEARS LATER, WITH THEIR COMPOSITE—THE COMPOSITE IN THE CENTRE.



PLATE III. THE FACES OF TWELVE HORSE-CAR CONDUCTORS AND THEIR COMPOSITE—THE COMPOSITE IN THE CENTRE.

themselves round the bull's-eye of a target. An illustration of the way in which an ideal figure may be constructed from physical measurements of a large number of individuals is afforded by the figures of the typical American students furnished by Professor D. A. Sargent for the educa-

tional department of the Columbian Exposition.

There are, however, certain anatomical peculiarities of too subtile a character to be expressed in figures, but producing results which reveal themselves with unerring certainty to the trained eye. The expression of the



PLATE IV. THE FACES OF TWELVE HORSE-CAR DRIVERS AND THEIR COMPOSITE—THE COMPOSITE IN THE CENTRE.

countenance, for example, depends entirely upon the complicated relations between the different parts of the skin of the face, but it is obviously impossible by the application of a measuring tape to distinguish between such faces, for instance, as those of an uneducated and of a liberally educated

man. The eye, however, detects this difference at once. For the recognition of racial peculiarities the unmeasurable seem to be more important than the measurable differences. We say without hesitation: "This man looks like an Englishman, that one like a Russian," and we feel a greater confidence

in the conclusion thus reached through the unaided eye than in the results of scientifically conducted cranial measurements. In forming a judgment of this sort we compare the individual in question with our mental conception of an Englishman or a Russian derived from previous observation of persons of those nationalities. Such a mental conception, unless derived from very extensive observation, is, of course, likely to vary very much in different individuals, owing to their varying experience in the observation of foreigners. This lack of anything objective in the conception of racial physiognomy renders scientific discussion of the subject quite impossible, and shows clearly the importance of devising some method by which mean or average values may be determined for those unmeasurable anatomical peculiarities upon which the expression of the countenance depends.

To Francis Galton belongs the credit of being the first to propose a solution of this problem. In his article on composite portraits ("Nature," May 23, 1878), he called attention to the possibility of employing the photographic camera to combine the features of a number of individuals upon the same sensitive plate, thus producing a typical portrait of the group by "bringing into evidence all the traits in which there is agreement," and leaving "but a ghost of a trace of individual peculiarities." Improved methods and the results of their application were described by the author in subsequent articles and in his work entitled "Inquiries into Human Faculty and its Development," published in 1883.

In 1886 and 1887 the subject attracted much attention in this country, and in many of the colleges composite photographs of the graduating classes were produced.

The strong family likeness which was observed between the composite portraits of these different groups of educated American youths was rightly regarded as evidence that the features thus produced are really typical of the groups in question, but the value of the process as a method of ethnological

research does not seem to have been generally conceded. It certainly has not been utilized by ethnologists to establish types of national physiognomy in a way that might reasonably have been expected had Galton's opinion as to its importance been generally regarded as well founded.

It is evident, therefore, that a further inquiry into the value of composite photography cannot be regarded as superfluous, and the object of the present paper is to present certain additional evidence bearing upon the question whether the features and expression of a composite photograph are really typical of the group of faces from which it is obtained.

It is obvious at the outset that, since we are dealing with unmeasurable anatomical peculiarities, no such tests can be used as are applicable in the case of the measurable dimensions of the figure.

It is useless to try to determine, for instance, whether the dimensions of the features of the components group themselves round the corresponding features of the composite in accordance with the law of accidental variation, for we are not concerned with the size of the features, but with the expression of the countenance, which cannot be indicated by any numerical formula.

It would seem, therefore, that the only way to begin an inquiry of this sort is to study carefully the individual faces of a given group, asking ourselves what traits and expressions are common to them all, and then to ascertain whether these traits and expressions are faithfully presented in the features of the composite portrait. Let us examine in this way the faces shown in Plate I., which are those of a small dinner club composed of twelve Boston physicians, with the composite portrait in the middle. If we seek to discover traits which are common to the whole group, it will be evident that in two respects only do the features of each of these twelve faces present the same expression. In the first place, the faces are all those of middle-aged men, i.e., of men of about forty-five years of age; and, secondly, they are all faces



PLATE V. A GROUP OF SAXON SOLDIERS AND THEIR COMPOSITE—THE COMPOSITE IN THE CENTRE.

of educated men. In no other respect do the faces seem to resemble each other.

Let us now consider whether the composite picture presents these common traits. Is this portrait that of a middle-aged educated man? There can be little doubt that an affirmative

reply must be given to this question. The face is distinctly intellectual in its character, and the apparent age is not far from the average age of the components, viz., forty-five years.

The method of composite photography has, therefore, in this case, at any rate, produced a portrait which may be



PLATE VI. A SECOND GROUP OF SAXON SOLDIERS AND THEIR COMPOSITE—THE COMPOSITE IN THE CENTRE.

regarded as typical of the components, since its features fairly represent the group in respect to the only two qualities, namely, age and intelligence, in which the individual faces resemble each other.

As a further test of the value of composite photography, let us now compare

this picture with others in which the components differ in age or in grade of intelligence, in order to ascertain whether corresponding differences reveal themselves in the composite portraits. To this end it will be found interesting to compare the component faces in Plate I. with the same faces



PLATE VII. A GROUP OF WEND SOLDIERS AND THEIR COMPOSITE—THE COMPOSITE IN THE CENTRE.

photographed five years later, as shown in Plate II. It will be noticed in the first place that the interval of five years has in most cases made little difference in the apparent age of the individual members of the group. This is what might be expected, for the faces are those of men who are

all upon the plateau of middle life, where the passing years leave much less trace than at earlier and later periods. Except that the expression of the countenance is, perhaps, in general, rather less grave in the later than in the earlier photographs, it is not easy to discover any change which

can be regarded as presenting itself in the whole group.

If we now compare the composite pictures it will be seen that the difference in the apparent age of the two portraits is not more marked than in the case of the components. Most persons will be inclined to regard the later picture as that of a slightly older man, but the opposite opinion has also been expressed. The countenance of the composite seems to have become, during the interval of five years, less serious and student-like, and perhaps rather more philosophical, in its expression. There is always, however, room for a difference of opinion in interpreting the expression of the somewhat vague and shadowy features of a composite photograph.

Owing to the slight difference in the age of the components in these two pictures, their comparison cannot be said to show conclusively how far the process can be depended upon to produce a face of an apparent age representing that of the components. The test might be very easily applied by collecting photographs of school children, producing composites of those of corresponding ages, and then ascertaining whether the portraits thus obtained arrange themselves in a natural series representing successive ages.

Let us now compare the group of professional men and their composite with similar groups of men who have not enjoyed the advantage of a liberal education. On Plate III. are exhibited the faces of twelve horse-car conductors, and on Plate IV. those of the same number of horse-car drivers. A study of either the components or the composites of these three groups shows clearly that, with respect to intellectual expression of countenance, the conductors occupy a position intermediate between that of the professional men and that of the drivers.

We have thus three groups of portraits, the doctors, the conductors, and the drivers, each group characterized by a different grade of intellectual development, and that grade fairly constant within each group. Now, since the composites of these groups

show a corresponding difference, it seems to be a reasonable conclusion that, as far as intelligence is concerned, the composite portrait fairly represents the typical physiognomy of the group to which it belongs.

Additional evidence on this point could be obtained by uniting in the same group intellectual and unintellectual faces in varying proportions, and ascertaining whether the composites of the groups thus formed would arrange themselves in a natural series in which the degree of intelligence displayed in the countenance increased with the relative proportion of the intellectual over the unintellectual faces. Should circumstances favor the undertaking, a study of this sort may at some future time be attempted.

Since the method of composite photography seems to be capable of producing a portrait which is intellectually typical of the group from which it is taken, we are encouraged to hope that for those differences of feature which distinguish the various branches of the human race the same process may also prove useful and may furnish us with an objective basis for the study of racial physiognomy, in place of the purely subjective conceptions upon which we are now compelled to rely.

As a contribution to this study, four groups, each of twelve soldiers with their composite, are presented in Plates V. to VIII. The original photographs, which are all of soldiers belonging to the Saxon army, were obtained through the kindness of General von Funcke of Dresden. The soldiers represented in Plates V. and VI. belong to Saxon regiments, while those shown in Plates VII. and VIII. are Wends. The latter are a Slavic race, and thus ethnologically belong to a very different branch of the human family from the Saxons. It is, of course, not to be supposed that either Saxons or Wends are at the present time, in any sense, a pure race, but they are sufficiently distinct to be enrolled in separate regiments, and in Saxony it is generally considered that the Wends are a sturdier and more vigorous race than the Saxons. A study of the faces here presented cer-



PLATE VIII. A SECOND GROUP OF WEND SOLDIERS AND THEIR COMPOSITE—THE COMPOSITE IN THE CENTRE.

tainly suggests the conclusion that there must be some racial peculiarities showing themselves in the composite portraits. The two composites of each race are clearly more like each other than like those of the other race, and the squarely cut jaw and brow of the Wend composites give the impression

of greater vigor and strength of character than the more rounded features of the Saxons. The beautifying effect of the process is very clearly shown in these pictures, an effect which Galton has explained by the fact that the features of the composite are always regular, since the irregularities due to

individual peculiarities necessarily disappear from the final result.

The question whether composite photography is likely to be an important method of ethnological research can be answered only after it has been extensively employed by experienced anthropologists. All that can be claimed for the present investigation is, that its results are sufficiently encouraging to justify a further prosecution of the work.

In judging of the value of the evidence here presented, it is proper to bear in mind that, even by the best processes of mechanical reproduction, photographs lose something of their delicacy and beauty, and that this is particularly the case when the photographs are lacking in clearness. It is for this reason that, in spite of the persistent efforts of the publishers, for which the writer desires to express his grateful thanks, it has been found impossible to reproduce satisfactorily the photographs of the horse-car conductors and drivers, for these pictures were taken under rather unfortunate conditions, and the original negatives lacked many of the qualities of a good photograph.

The process of making composite pictures is exceedingly simple, and the necessary apparatus very readily constructed. In the appendix to his "Inquiries into Human Faculty," Galton has described the very elaborate and perfect form of apparatus which he has used in his studies; but entirely satisfactory results may be obtained with much more simple contrivances. The instrument used by the writer is merely an old-fashioned box camera, with a hole cut in the top for the reception of the ground-glass plate upon which the image is to be reflected for purposes of adjustment. The reflection is effected by a mirror set at an angle of forty-five degrees in the axis of the camera, and pivoted on its upper border so that, after the adjustment of the image, the mirror can be turned against the upper side of the box, and the image allowed to fall on the sensitive plate at the back of the camera. The original negatives are used as components, and are placed in succes-

sion in a small wooden frame which is pressed by elliptical springs against a sheet of glass fastened vertically in front of the camera. By means of this arrangement it is possible to place each negative in succession in any desired position in a plane perpendicular to the axis of the camera, and thus to adjust it so that the eyes and the mouth of its optical image shall fall upon the fiducial lines drawn upon the ground-glass plate at the top of the camera. An Argand gas burner with a condensing lens furnishes the necessary illumination.

For our amateur photographers, who are constantly seeking new worlds to conquer, the opportunity of doing useful work in developing the possibilities of composite photography ought to be very welcome. Not only will the science of ethnology profit by their labors, but by making composites of persons nearly related to each other, a new and very interesting kind of family portrait may be produced. The effect of occupation on the physiognomy may also be studied in this way. By comparing, for instance, the composite of a group of doctors with that of a group of lawyers, we may hope to ascertain whether there is such a thing as a distinct legal or medical physiognomy. The experiments made some years since by Professor Pumpelly in combining the naturalists and the mathematicians of the National Academy into two composite portraits* justifies the hope that very interesting results may be expected from this method of investigation.

Apart from the value of the conclusions to be drawn from such experiments, the process itself is one of the most interesting that can occupy the attention of a photographer. The unexpected beauty of the positive picture slowly revealing itself in the developing tray imparts a fascination to the pursuit unequalled in any other kind of photographic work.

As a subject at once attractive and important, these investigations are to be commended to all who are interested in photography either from an artistic or a scientific point of view.

* See "Science," May 8, 1885.

